Molecular physiology of water balance

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TO THE EDITOR: In their review article on water balance, Knepper et al. (April 2 issue)[1] discuss water channels (aquaporins) in renal tubular cells. They omit mention of the critical role played by aquaporin-1 in microvascular endothelia.

In the renal microvasculature, endothelial aquaporin-1 mediates the osmotic water efflux across descending vasa recta and is required for regulation of medullary blood flow, maintenance of the medullary interstitial gradient, and urinary concentrating ability.[2]

Aquaporin-1 is also highly expressed in the endothelium lining peritoneal capillaries, where it facilitates osmotically driven water transport during peritoneal dialysis. Peritoneal dialysis is a technique of renal-replacement therapy that is increasingly used worldwide to restore homeostasis, including water balance, in patients with end-stage renal disease.[3] Studies in experimental models have shown that aquaporin-1 mediates up to 50% of ultrafiltration during peritoneal dialysis with crystalloid (glucose-based) solutions.[4] In these models, pharmacologic regulation of aquaporin-1, either through induction with glucocorticoids[4] or gating with furosemide-based compounds,[5] enhances aquaporin-1–mediated water transport across the peritoneal membrane. These data show the important role of endothelial water channels in water homeostasis.

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No potential conflict of interest relevant to this letter was reported.

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THE AUTHORS REPLY: Morelle and colleagues point out several key roles of aquaporin-1 in microvascular endothelia that are relevant to our article. We agree with their points and add the following ones. Aquaporin-1 is strongly expressed in the endothelium of the descending vasa recta of the renal medulla.[1] The resulting high water permeability of the descending vasa recta[2] contributes to the countercurrent exchange process that permits perfusion of the renal medulla without dissipation of medullary solute gradients.[3] Therefore, aquaporin-1 expression in the vasa recta is crucial to the ability of the kidneys to conserve water.

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Since publication of their article, the authors report no further potential conflict of interest.

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